ABSTRACT

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The conclusion that organization is fundamental and necessary for recall performance has often been made by researchers who tested adult subjects. However, developmental studies in which category clustering and subjective organization were used as measures of mnemonic organization often failed to support, fully, the hypothesis that recall is dependent upon organization.

A review of the literature concerning childrens' clustering organization and subjective organization indicated that the hypothesized relationship between organization and recall can be maintained, if traditional definitions of organization are expanded to include organization criteria other than conceptual ones. Organizational strategies of young children were described as relating to perceptual attributes of the experimental items more than to abstract conceptual attributes that have traditionally been designated as organization. Developmental changes in organization were discussed as evidence for a perceptual-conceptual continuum.

It was also concluded that current information-processing models of memory, generated from research with adult subjects may be ineffective in accounting for developmental changes in information processing in children.

The differential development of a child's ability to organize and his ability to apply that organization in a memory task for the purpose of facilitating recall was discussed as a possession-utilization continuum. This possession-utilization continuum was contrasted with current arguments concerning production and mediation deficiencies in children. The possession-utilization framework was used to reconcile research results concerning the presence or absence of mnemonic organization in children.

DEVELOPMENTAL CHANGES IN MNEMONIC ORGANIZATION IN CHILDREN

by

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CHAPTER I

INTRODUCTION

Experimental investigation of memory can be traced to early studies which were largely concerned with verbal learning rather than memory (Kausler, 1974). Currently a line of departure can be seen between those studies primarily concerned with the active strategies used by the subject and those studies primarily concerned with the nature of the verbal material itself. The study of memory using adult subjects has traditionally emphasized organization as a strategy or process considered fundamental and necessary to memory (Bower, 1970; Hultsch, 1971; Tulving, 1962). From a traditional point of view organization may be defined as a mental or cognitive classifying scheme imposed on stimulus items for the purpose of facilitating recall of the items.

Developmental studies of organizational strategies illustrate two major emphases. There are those studies in which children are used as an alternative population to test hypotheses-generated by adult populations--about organization and its role in memory (e.g., Laurence, 1966; Mandler & Pearlstone, 1966; Mandler & Stephens, 1967; Rosner, 1971). In addition, there are those studies primarily interested in memory as it appears in children (e.g., Bousfield, Esterson, & White, 1958; Cole, Frankel, & Sharp, 1971; Denney & Ziobrowski

1972; Kobasigawa, 1974; Kobasigawa & Middleton, 1972; Lange, 1973; Lange & Jackson, 1974; Neimark, Slotnick, & Ulrich, 1971; Nelson, 1969; Ritter, Kaprove, Fitch, & Flavell, 1973; Worden, 1974). The former emphasized characteristics of memory and organization while the latter emphasized characteristics of children.

This paper will focus on the development of mnemonic organization in children as a prototype of cognitive development. This parallel relationship between the development of memory and the development of cognition was suggested by Flavell (1971) and Corsini (1971). The position will be taken that current models of memory originally generated by adult studies are ineffective in accounting for developmental changes in the form of organization and its role in memory. Traditional conceptualizations of organization need to be expanded or modified to account for the variations in cognitive activity which occur in children with increasing age. The term organization will be used here to include age-related qualitative differences in cognitive activity. Developmental changes in organization will be discussed in terms of a perceptual-conceptual continuum. A possession-utilization continuum will be used in an attempt to explain the presence, absence, or emergence of age-related organization schemes in children. This continuum--constructed from notions put forth by Moely, Olson, Halwes, and Flavell (1969) and Lange (1973)--is an attempt to reconcile the production deficiency (Flavell, Beach, & Chinsky, 1966) versus

mediation deficiency argument (Reese, 1962) in developmental terms, rather than viewing these as either/or propositions. The production-mediation argument will be explained at a later point but is not central to the focus of the paper. The possession-utilization continuum as a developmental phenomenon seems to explain the well-documented finding that children possess the ability to organize before they are able to apply that ability to a memory task for the purpose of increasing recall.

CHAPTER II

MODELS OF MEMORY: AN OVERVIEW

S-R versus information processing. Since the act of remembering is an unobservable event, it readily lends itself to a variety of theoretical models (Kausler, 1974). Current information-processing models of memory have been proposed to more closely approximate the active role played by the subject in determining what will be remembered and how it will be remembered. In contrast, earlier stimulus-response models assumed the subject to be a passive recipient of environmental events. According to the stimulus-response models, memory depended on the strength of the bond or association occurring at the time of stimulus presentation. This strength could be altered by the amount of delay and interference between study and recall or by the availability of an association with an item previously stored. Since S-R models were formulated before information-processing models, it is not surprising that they were more specifically related to verbal learning phenomena.

Information-processing models are broader in scope not only in terms of the subject's role but also in terms of the nature of the stimulus materials. Information-processing models attempt to encompass processes of attention as well as of memory and are not limited to the processing of verbal material (Kausler, 1974). Information-processing models,

analogous to computer operation, are generally pictured as flow diagrams of bins and channels which attempt to account for both storage and retrieval of information. Organization is thought to represent either a storage mechanism or a retrieval mechanism or both. The distribution of information from one bin to another and the choice of mnemonic strategy, i.e., rehearsal or organization, are left up to the subject.

It should be noted that models of memory were originally constructed to account for adult memory. Developmental considerations raise a question regarding the appropriateness of the passive, S-R and active, information-processing models of memory. Some investigators (Flavell, Friedrichs, & Hoyt, 1970) have suggested that the ability to actively process information appears only in older children when they begin to use more adult-like strategies. If this is true, models which view the individual in a more passive role may prove more appropriate to explain memory in younger children. However, it seems rather awkward to propose one model of memory to account for mnemonic strategies of young children and a different model for older children and adults.

The role of rehearsal. Information-processing models of memory are concerned with both the storage of information in memory and the retrieval of information from memory. A major part of early investigations dealt with rehearsal as a storage mechanism. Evidence for rehearsal, i.e., repetitive verbalization of an item, as a strategy for remembering is supplied by

behavioral observation and verbal report. The serial-recall task has traditionally been the paradigm of choice for studying rehearsal strategies in both children and adults (Hagen, 1971; Kingsley & Hagen, 1969). In this task, the subject is given a series of words, objects, or pictures to study for a short period and is then asked to recall the items in the same order as they were presented. If the probability of recall of each item is plotted as a function of its position of presentation in the series, a U-shaped curve is generated, indicating that more items are recalled from the beginning and end of the list than from the middle.

This classic serial-position curve whose left side represents the items recalled from the first part of the list (primacy effect) and whose right side represents the items recalled from the end of the list (recency effect) is traditionally accepted, in an information-processing model, as evidence for different processing stations being activated during a memory task. For those who emphasize the storage component of the information-processing model (Atkinson & Shiffrin, 1968), the two extremes of the serial-recall curve are believed to represent output from long-term and short-term memory. Rehearsal is thought to account for the primacy effect by transferring items to or by maintaining items in long-term memory. On the other hand, short-term memory needs no active maintenance due to the short time interval just prior to recall, and the recency effect is produced by the subject's merely "dumping out" the

last few items in recall. As a subject repeats a series of items over and over in his effort to "learn" or "remember" them, the first items presented in the series will be rehearsed more times than items presented later in the series. This rehearsal results in increased recall for early items, i.e., the primacy effect. Since the latter items in the list would not have had this opportunity to be rehearsed, some other mechanism is needed to account for the increased recall of the latter items. A short-term memory system with its "dumping" mechanism has gone essentially unchallenged as the underlying mechanism responsible for the recency effect. For investigators emphasizing retrieval components of the memory system (Tulving, 1962), rehearsal plays a differential retrieval role rather than a differential storage role.

Rehearsal occurs spontaneously in older children and adults but fails to occur spontaneously in young children (Hagen, 1971; Kingsley & Hagen, 1969). However, if young children are forced to rehearse in an experimental task, their recall is better than that of children who do not rehearse (Kingsley & Hagen, 1969). These results emphasize the importance of rehearsal in memory of children, and similar results have been found in studies in which children have been forced to use organization as a memory plan. The latter results will be discussed in greater detail in subsequent sections of this paper.

Storage and retrieval in children. Although storage and retrieval roles of organization in children have been dealt with experimentally in either an implied (Moely et al. 1969) or a direct manner (Kobosigawa, 1974; Worden, 1974), the assumptions are often geared more toward adult model testing than they are toward developmental parsimony. Short-term and long-term storage models seem to require that mnemonic schemes for auditory and visual material may be different for children and adults (Hasher & Clifton, 1974). This would seem to require that short-term and long-term storage play one role for children and another for adults. Craik and Lockhart's (1972) "levels of processing" conceptualization of memory is more concerned with processing activity itself rather than the filing system and, so, seems more developmentally interpretable. However, current research is generally attuned to ideas of storage and retrieval in children (Kobasigawa & Orr, 1973; Ritter, Kaprove, Fitch, & Flavell, 1973).

If it is reasonable to conceptualize memory in terms of computer models, it might be assumed that only what is programmed in can be retrieved. It is often assumed that from this point of view, organization would play a greater role during the storage process than during the retrieval process. Attempts to examine the focus of the effects of organization on memory can be divided into two types: (a) those which examine the effects of organization on storage by manipulating study conditions while recall (retrieval) conditions are held constant; and, (b) those which examine the effects of

organization on retrieval by holding study (storage) factors constant and manipulating recall conditions. It is generally assumed, however, that mere provision of certain study conditions insures that the information will be stored just as it is presented by the experimenter. However, this assumption might not always be valid in the case of children. If these conditions can be assumed to reflect the use of organization during storage, then the experimenter's task is to see under what conditions information will be retrieved.

Kobasigawa (1974) provided carefully controlled conditions to first-, third-, and sixth-grade children and varied retrieval conditions to test for the development of effective use of retrieval cues. He compared retention for conditions of free recall, cued recall, and directed cued recall. In the cued condition, children were provided during recall with a deck of cards that had previously been paired with the study items. If it occurred to the child to look at the cards (he had been told that he might look), each picture should assist in the recall of the three items with which it had been paired during study. In the directive cue condition, the child was explicitly told that each card was related to three items that he had studied. There was no difference between the free recall and cued recall of first and third graders, although the third graders made greater spontaneous use of the retrieval cues. On the other hand, directed cuing greatly improved recall for first and third graders. Sixth graders used the cues in a more

systematic manner than did the third graders who used them. For the sixth graders, the directed cue condition did not produce recall effects greater than those achieved in the cue condition, but retention with either type of cuing was superior to retention under the free recall condition. In conclusion, Kobasigawa stated that "the similarity in recall scores across the three age groups under the directive cue condition appears to indicate that the highly similar amount of information was available in storage at all grade levels." (p. 133). If this can be assumed, then the present data for the free recall condition (younger subjects recalled less than older subjects) may be considered as evidence for the hypothesis that younger subjects seem to have greater difficulty than older subjects in retrieving information from storage.

It seems unnecessary to assume that the information was stored merely because it was provided by the experimenter in the study condition. If age-related differences in retrieval could be explained on the basis of incomplete storage during study, it is not surprising that younger children required stronger or directive cuing to recall information. A milder cue would be expected to be ineffective under conditions where storage was incomplete. Since use of the milder cue was, in addition, optional rather than forced, it is not surprising that younger children failed to use it spontaneously. Those younger children who did refer to picture cues in a spontaneous manner were reported to use them in a rote fashion. In other

words, each cue seemed to facilitate the recall of only one item rather than facilitating the recall of the organization which, in turn, should assist recall of several items. This non-strategic use of the cues suggests an effective threshold had not been reached which would insure appropriate cue utilization for the purpose of recalling the items studied.

Kobasigawa interpreted the younger children's lack of spontaneous and effective use of the cues in terms of an inability to simultaneously focus attention on three different parts of the retrieval process: (a) recall the study item; (b) look at the cue; and (c) maintain these actions long enough to retrieve one item per cue. If the attentional processes are incapable of integrating these actions during retrieval, it would seem unreasonable to assume they would have been effective in processing the information during study. The storage task, as structured by Kobasigawa, likewise involved several steps.

Worden (1974) made a strong argument for the importance of organization at storage. She required first, third, and sixth graders to sort pictures into either two or six categories prior to recall. All subjects sorted correctly under these conditions, and there were no differences in retention under any of the retrieval conditions -- no cues, category labels as cues, and blocked recall. In blocked recall, the experimenter gives a category label, and the subject recalls as many study items as possible belonging to that category. This procedure then is followed for each category that was

present in the list. Worden's conclusion was that, once organization was stable, additional organization that was provided at retrieval had no effect.

Lange (1973) compared the recall and clustering of kindergarten, fifth-grade, and ninth-grade children in a free recall condition and two cued conditions. The stimulus items were pictures that could be categorized as food, clothing, furniture, and animals. In one cued condition, category labels were presented during study, and the children pointed to the appropriate instances of each label. In the other condition, category cues and pointing procedures were repeated; but, in addition, category cues were provided during recall as subjects recalled the items in blocked sequence. The cue-at-study condition did not produce better recall than the free-condition in which cues were not provided. It can be assumed that the category label in the study-cue condition either did not provide sufficiently strong inducement to get the children to utilize category organization at storage or, alternatively, the children used category organization but retrieval was faulty. The fact that blocked recall was better than free recall lends some support to a retrieval deficiency argument. The question then arises, as to whether the retrieval cuing is, in fact, providing the organization at retrieval rather than merely making storage organization operative.

CHAPTER III

DEFINITIONS AND METHODOLOGY

What is organization? Organization does not have a direct, overt behavioral component. It is mental activity that must be operationally defined if it is to be studied. There are increasing attempts to include overt behavioral data, e.g., naming, pointing to item, self-testing, in studies designed to test organization, but the functional significance of such behaviors for memory performance has not been dealt with beyond a simple description of them (Appel, Cooper, McCarrell, Sims-Knight, Yussen, & Flavell, 1972; Flavell et al., 1970; Moely et al., 1969; Yussen, Gagne, Gargiulo, & Kunen, 1974). Organization, as originally defined in adult studies (Bousfield, 1958; Tulving, 1962), implies a rather high level of conceptual mental activity that may be beyond the developmental abilities of young children. Developmental data may require some modification of the way in which organization is conceptualized, in order to account for children's apparent cognitive activity which occurs above the level of rote recall and below the supraordinate conceptualization found in adults. These modifications may need only to broaden the scope of the definition of organization to account for qualitative differences in organization. Presently used quantitative measures may continue to be appropriately applied to qualitatively different dimensions of organization. For example, measures of clustering organization (to be indicated

subsequently) might just as appropriately quantify developmentally primitive modes of organization as discussed in this paper. Traditionally, however, these primitive mnemonic schemes are not defined as organization.

Organization is said to occur when a subject manipulates stimuli or stimulus events according to a rule or dimension not present in the actual items themselves. The subject imposes upon groups of items some sort of cohesiveness generated from his past experience or contrived meaning. For example, if a subject is given the words box, light, and room, in a long list of other items, he might think to himself, "Turn the light on in the room and look for the box." This is an example of idiosyncratic organization whose rationale would be difficult to test except by verbal report. Nevertheless, it would be credited as organization in a free-recall situation, if those three words appeared together in the subject's recall protocol in spite of the fact that they had never appeared together on any trial of the free-recall task.

The preferred paradigm for the study of organization has been that of free recall. The subject is presented a list of items for study and is later asked to recall them in any order that he chooses. The objective is to allow the subject as much freedom as possible in determining order of recall.

Experimenter-defined organization. Free recall studies of organization fall into two general categories of experimenter-defined organization and subject-defined organization. In experimenter-defined organization, the experimenter selects the stimulus items according to some criterion of meaning which which is not physically apparent in the stimuli themselves. The objective is to observe whether or not subjects organize the material on the basis of the relationships intentionally provided by the experimenter. The task for the subject is to detect this organizational option and to use it in his recall. Classic examples of quantifying the amount of experimenter-defined organization that is present in a subject's recall protocol are category-clustering measures originally designed by Bousfield (1953). Comparison and contrast of the various quantifying techniques are beyond the scope of this paper.

Category clustering is an example of higher-order, conceptual organization since the items in the list are representatives of the categories. An experimenter might compose a list of the following items: table, boat, carrot, train, bean, cabinet, tomato, car, bed. The order of presentation of these items is randomly varied for each trial. After each presentation trial, the subject is asked to recall the items in any order. If the subject, in spite of the changes in presentation order, persists on each trial to group the order of his recall in terms of the taxonomic categories of vehicles, furniture, and food, category clustering is said to have occurred.

If, on the other hand, the subject's order of recall persisted in the form of table, train, tomato, car, cabinet, carrot, bed, bean, boat, clustering would still be present. However, the level of organization would not be as conceptually elaborate or abstract. In the latter case, the subject's output is apparently organized on the basis of beginning letter (or sound if presented auditorily) which is a perceptual characteristic of the item. In the latter example, the subject ignored or failed to detect the categorical potential of the items and responded on the basis of a characteristic inherent in the stimulus items: beginning consonant. This example illustrates the fact that a subject often selects alternate choices of organization modes, even when care is taken to control for these variables. It should be noted that the perceptual-conceptual developmental continuum is prevalent in developmental research. Young children would be expected to group or classify items on the basis of perceptually concrete characteristics that are more directly related to the stimulus items rather than to group on the basis of more abstract relationships of meaning provided by the experimenter. This point will be treated more extensively in a later discussion of the presence of organization in children.

In subject-defined organization studies, the objective is to measure the extent to which a subject spontaneously imposes his own organization on the material that the experimenter has judged to be unrelated. In a multitrial free-recall paradigm,

originally posed by Tulving (1962), the subject studies a list of items that are presented in a different order on each trial. Organization is said to occur when the subject recalls the items in a consistent order that is independent of the order in which the items were presented for study. The consistent output order of groups of items is called clustering and is accepted as evidence for subjective organization. The assumption is that the persistent groups of items appearing in recall bear some sort of relatedness to the subject, but the nature of the relationship is probably unknown to the experimenter. However, if one considers the idiosyncratic relationships that a subject might impose on any group of items, there is in reality no such thing as a truly unrelated list. The term unrelated is used from the experimenter's point of view to suggest that he has eliminated any obvious relationships among items (Tulving, 1962). In the case of experimenter-defined, category clustering the fact that the experimenter can make a statement about the qualitative nature of the organization relative to the potential included in the list is incidental to measuring the amount of clustering and its relationship to the amount of information recalled. The measure of subjective organization does not make even an incidental attempt to identify the basis of the organization used in the subject's recall, although the nature of the subjective organization could probably be determined from the subject's protocol.

CHAPTER IV

SPECIAL DEVELOPMENTAL CONSIDERATIONS

Before the development of organization in children and its role in memory are discussed, it is important to note two developmental considerations that repeatedly make their appearance in studies involving children as subjects. Both pose methodological obstacles that are perhaps not too persistent in adult studies.

Awareness of task demands. The first consideration involves young children's awareness of task demands and the state of task readiness which they bring to an experimental situation. Several investigators have stressed the point that young children are not particularly "efficient" or "planful" in their approach to memory tasks and are generally unaware that the task requires some goal-directed activity to insure retention (Appel et al. (1972); Flavell et al., 1970; Neimark et al., 1970; Yussen et al., 1974).

Appel et al. (1972) suggested that young children recall less information than older children because the ability to perceive and the ability to memorize have not been differentiated in the young child. The authors predicted that young children would not show better recall when instructed to remember the items than when instructed to look at the items. To test this prediction, they gave one group of children composed of preschoolers, first graders, and fifth graders instructions to look at the pictures carefully for the purpose of

performing a non-recall task. The other group of children from the same grades were given instructions to remember the names of the pictures. Preschool children and first graders confirmed the differentiation hypothesis, since they showed the same level of recall for both instructional conditions when the pictures were presented in a simultaneous array. When the picture items were presented in successive order, preschoolers continued to show no differences in recall between the two instructional conditions. However, with successive presentation, first graders recalled more items with memory instructions than with look instructions. Fifth graders demonstrated better recall with instructions to remember than when they were merely instructed to look at the pictures, regardless of whether items were presented successively or simultaneously. This latter finding suggests that the differentiation between perception and memory was well established by about 10 years of age.

To investigate further the apparent discrepancies in the data of the first graders, Yussen et al. (1974) tested the same instructions and used the same picture stimuli. The pictures were simultaneously presented to groups of first, second, third, fourth, and fifth graders. The subjects at all ages recalled more items when they were instructed to remember than when they were merely instructed to look at the pictures. The combined results of these two studies suggest that even first graders are aware that some active process is necessary to

facilitate recall when they know they will later be asked to recall the items. It is unclear why first graders yielded different results under conditions of simultaneous and successive presentation of the picture items. Procedural differences might provide an explanation. The former investigators reported the use of a "foil task" which was presented to the subjects in the look condition to facilitate attendance to the task. The latter authors did not report the use of such a task. If subjects in the Yussen et al. (1974) study failed to attend to all of the items in the look condition, and/or if instructions to remember facilitated their attention in light of their ability to differentiate, better recall under instructions to remember would not be surprising.

In addition, behavioral data in the Yussen et al. (1974) study--if they represent even a gross developmental sequence--indicate that the children in the second study may have been more advanced or more homogeneous or both. In the second experiment, fewer first-grade children relied on sequential naming than in the first experiment, and more first graders in the second experiment demonstrated active categorizing by picture rearrangement. This sequence assumes that naming is developmentally more primitive than categorizing. If Yussen et al.'s first graders were more advanced, as suggested by the behavioral data, then differentiation between perceiving and memorizing would be more complete, and recall would be greater with instructions <u>to remember</u> even in chronologically younger first

graders. This explanation is consistent with the results of the study by Yussen et al. (1974). The behaviors of sequential naming, sequential pointing, rehearsal, and rearranging pictures by categories are assumed by the authors to reflect a general increase in active, planful involvement in the task. Sequential naming was the behavior most often observed at the preschool level and was observed just as often in the look condition as the memory condition. This outcome suggests that instructions to remember made preschoolers no more goal directed than instructions to look. Since recall did not differ between these two conditions, even in the presence of sequential naming, the authors concluded that this particular study behavior was not the result of a deliberate, intentional strategy but was merely naming for the sake of naming. Pointing, rehearsal, and picture rearranging, however, were observed to a greater extent in the older children and are assumed to be manifestations of cognitive activity applied to the task for the purpose of increasing recall in the memory condition.

Neimark et al. (1971) similarly reported behavioral evidence that suggested deliberate memorizing strategies were present in first graders but that these behaviors might not have reflected the subject's actual awareness of task demands. In summarizing the nature of responses for first graders, these authors stated, "After scanning each of the items in turn, he thinks he 'has them'; a number of the younger children announced that they were ready before the end of the three

minute study period interval. On recall they appeared surprised at the paucity of their output and scanned the testing room for associative cues to trigger remaining items. (p. 431). As in the previous study, overt behavior of young children in the Neimark et al. (1971) study did not necessarily reflect cognitive awareness of task demands. This description of the first graders' performance also reflects young children's inability to predict their own readiness to recall items in a memory task.

Flavell et al. (1970) dealt more directly with the issue of young children's awareness of task demands. They asked children from nursery school, kindergarten, and second and fourth grade to predict their own immediate memory span. In addition, the children were asked to estimate their readiness to recall a series of items that was equal in length to their actual individual memory span. To determine the child's predicted memory span, each child was shown a series of first one item, then two items, and so forth to ten items. After each series of a different length, the subject merely responded if he thought he could remember the names on n items if the experimenter covered them. Each subject's actual memory span was tested by having the experimenter call out varied list lengths of familiar items and asking the subject to recall them in the order they were presented. Actual span was defined as the longest list the subject could recall correctly. In a final task, each child was asked to estimate his

readiness to recall information after an untimed study period. After being acquainted with the mechanics of an apparatus which permitted the child to expose pictures one at a time, the subject was told to study each item in a series as long as he wished and to signal the experimenter when ready to recall.

Flavell et al. reported that the children's approach to the task became more "responsive" and "realistic" with increasing age and that accuracy of prediction of memory span and of recall readiness increased with age. However, the abilities of predicting memory span and predicting recall readiness apparently operated somewhat independently, since the best performers in each condition were not necessarily the same subjects. It is interesting to note that prediction of memory span was performed through visually presented material, but actual memory span was measured by auditory presentation of verbal material. If actual and predicted memory spans had been measured within the same sensory channel using similar material, the age-related differences between the two may have been smaller for all ages. In addition, if visual processing is more efficient than auditory processing in children as young as nursery school and kindergarten age, auditory processing seems an unfair test of actual memory span when the predicted span was obtained from visual processing. This confounding may even be independent of the developmental advantage of pictures over verbal material in young children (Cole, Frankel, & Sharp, 1971).

In summary, it is apparent from the preceding studies that any interpretation of results concerning organization in children's memory must take into account the child's ability to attend to and to understand relevant task demands. Such task awareness must occur before appropriate processing strategies can be selected by the child if, in fact, more than one strategy is available to young children.

Possession versus utilization. The second important developmental consideration affecting the presence or absence of a given organizational strategy involves the possession versus utilization phenomenon. This phenomenon has its foundations in the production-deficiency versus mediation-deficiency argument which reappears from time to time in the literature (Moely et al., 1969; Reese, 1962). Kendler, Kendler, and Wells (1960) noted, "There is a stage in human development in which verbal responses, though available, do not readily mediate between external stimuli and overt responses (p. 87)." Referring to this conclusion, Reese (1962) used the term mediational deficiency. A mediation deficiency is said to exist when a subject possesses an ability or a skill which should facilitate recall if it is brought into use during a task. However, for some reason, the ability, when used, fails to produce the expected facilitation. Flavell, Beach, and Chinsky (1966) reconceptualized the notion by considering the phenomenon to be a production deficiency rather than a mediation deficiency. They reasoned that, even though children possess a certain amount of

verbal facility, they fail to produce it in a task-appropriate manner. Thus, a production deficiency is said to occur when a subject possesses a skill but does not spontaneously bring it forth for the specific purpose of task performance, even though better performance could be guaranteed if the skill were used. If verbalization--an overt behavior assumed to reflect mediation--is induced, the expected mediational value is apparent in increased recall. Lange (1973) perhaps offered a more accurate description in the term utilization deficiency. In other words, a child may possess some ability, such as the ability to organize information, but for some reason fails to utilize it spontaneously in a memory task. This concept allows for both a production deficit and a mediation deficit to occur at different points in development. It might also reflect different points on the task acquisition--task performance continuum (Moely et al., 1969). In this case a subject may fail to utilize a strategy effectively while acquiring knowledge of a task. As familiarity with the task increases, utilization will be more apt to appear.

Moely et al. (1969) designed an experiment to evaluate the relative merits of the mediation deficiency and production deficiency hypothesis. Nevertheless, they concluded with an allusion to the same "point in development" described by Kendler et al. (1960) by stating, "It is possible that when a symbolic operation is very newly acquired, one might for a time also find some genuine mediation deficiency" (p. 32).

The major results of this study were interpreted in favor of a production deficiency since first, third, and fifth grade subjects increased their recall after being induced via a training procedure to use category organization. Trained subjects' recall reflected the use of category clustering, and their recall was greater than that of untrained subjects. Although the untrained subjects did not exhibit category clustering in their recall, they were able to sort the pictured items by their respective taxonomic categories during a post-experimental sorting task. In effect, even the untrained subjects possessed the ability to categorize the experimental material although they did not spontaneously utilize this ability for the purpose of assisting their recall. Trained subjects who did utilize the organizational strategy demonstrated superior recall--a finding which suggests that, if the untrained subjects had used the organizational, their recall would likewise have increased.

Moely et al. (1969) suggested an interesting possibility as to why young children fail to utilize a skill they obviously possess. The subjects apparently possessed the category organization ability to different "degrees" (p. 32). These degrees of organization may include a subthreshold developmental status which must be overcome before use of the skill for a given memory task can occur spontaneously and be effective in facilitating retention. The appearance of study behaviors described in preceding studies (Appel et al., 1972; Neimark et al., 1971; Yussen et al., 1974) would seem to represent a

mediational deficiency in young first-grade children, since the behavior assumed to reflect processing activity occurred but was not accompanied by increased recall. On the other hand, possession of the study behavior reflecting cognitive activity may have been developed only to the point of needing more practice before it could be applied effectively as an organizational scheme in a recall task. Other investigators have repeatedly demonstrated that even young children possess the ability to categorize material, but they fail to use this category organizational strategy for the purpose of facilitating their recall (Denney & Acito, 1974; Denney & Ziobrowski, 1972; Kobasigawa & Orr, 1973; Lange, 1973; Moely & Jeffrey, 1974; Neimark et al., 1971). Young children apparently practice a strategy merely for the sake of practicing the strategy before they are developmentally ready to utilize the strategy as a means to another end. This function is probably similar to what Piaget describes as exercising the schemata (Ginsburg & Opper, 1969).

Moely et al. (1974) postulated "degrees of possession" in children, apparently, on the basis of the observation that some children in the control group were able to sort the pictured items more completely into categories than others in a post-recall sorting task. It does not seem reasonable that a subject could apply an organizational strategy to a level greater than his possession or knowledge of the organizational scheme. It may be, however, that a child's ability to utilize an organizational scheme is equal to or less than his level of possession

of the scheme. In other words, utilization cannot exceed possession at any point. In addition to degrees of possession increasing with development, degrees of utilization may need to be considered equally developmentally dependent. Studies which have measured existence of organization, independent of its utilization as reflected in recall, may suggest evidence for developmentally related degrees of utilization. Moely et al. (1969) found fifth graders to have greater organization during their sorting of category items than was reflected in their recall scores. Moely and Jeffrey (1974) found similar results for six- and seven-year-olds.

There is a possibility that at least part of the possession-utilization discrepancy might be an artifact which can be minimized by methodological alterations that allow the child full awareness of the organizational scheme. These methodological approaches, however, may merely represent an induced form of what would otherwise have occurred spontaneously. Conversely, inattentiveness to the relevant task demands may account for the apparent lack of spontaneity. For example, Worden (1974) shows that the discrepancy can be overcome by encouraging complete possession of the appropriate organizational scheme during the study task. She investigated recall in children from grades one, three, and five and found that presenting them with an opportunity to visualize a spatial grouping of the items, as well as providing sorting and labeling experience, facilitated recall and organization. In this study, there were

no differences in recall organization between spontaneous free recall and cued recall. This lack of organizational differences between the two conditions may be attributed to attainment of a complete, stable organization prior to recall (Lange & Jackson, 1974); Mandler & Pearlstone, 1966; Mandler & Stephens, 1967).

It is apparent from the preceding discussion that variations in children's awareness of task demands and the developmental availability of an organizational scheme may affect task performance. In addition, the ability to apply or to utilize a skill that he possesses is attenuated in young children. Both possession and utilization of an organizational scheme are apparently developmentally dependent and appear by degrees. The overlap or interaction between degrees of possession and degrees of utilization of an organizational scheme influences its appearance in a recall task.

CHAPTER V

THE RELATIONSHIP BETWEEN ORGANIZATION AND RECALL

Category organization and number of items recalled have repeatedly been demonstrated to increase with age (Cole et al., 1971; Kobasigawa & Middleton, 1974; Moely et al., 1969; and Neimark et al., 1971). It is clear, however, that category clustering does not always increase in as linear a fashion as recall (Cole et al., 1971; Denney & Ziobrowski, 1972; Laurence, 1966; Moely & Shapiro, 1971; Neimark et al., 1971; Rosner, 1971; Yussen et al., 1974). It has been firmly demonstrated that adults are able to recall more information than children (Denney & Ziobrowski, 1972; Lange & Jackson, 1974; Laurence, 1966; Liberty & Ornstein, 1973). Since increases in adult organization have been found to closely parallel increases in adult recall in multitrial free recall studies (Mandler & Pearlstone, 1966; Tulving, 1962), it is probably reasonable to pose a cause and effect relationship between organization and recall. The fact that lower levels of organization in children are associated with lower levels of recall tends to support the hypothesis, generated by adult studies, that organization and recall are causally related. It has been pointed out, however, that certain measures of organization are apt to yield information supporting the organization and recall relationship, whereas other measures of organization do not. Some methods of measuring organization are based on the assumption that recall

is dependent on organization. Other computations do not make this assumption and, therefore, would tend to reject the cause and effect hypothesis between organization and recall (Liberty & Ornstein, 1973; Moely & Jeffrey, 1974). Laurence (1966) concluded that organization, as measured by subjective organization, could not be held responsible for age-related increases in recall since subjective organization did not increase with age in groups of children. If organization is not responsible for increases in children's recall, then something else needs to assume this role. Different types of organization schemes, other than the traditional category clustering and subjective organization, might offer some accountability for increases in recall in children.

CHAPTER VI

DEVELOPMENT OF ORGANIZATION

Preferred organizational strategies. A preferred organizational strategy is one that is used by a subject in a memory task if several possibilities are available. The term is often used with the connotation that only one strategy is generally used at any given developmental level. As the child grows older, he has more organizational schemes available to him, since developmentally earlier and later ones have already been mastered. In any given task, the choice of a strategy might reflect a cognitive level that will insure task success. Mandler and Pearlstone (1966) suggest that a preferred organizational scheme is rather automatic and does not change for different stimulus materials. In this study, four groups of free sorting adults were yoked with four respective groups of adults whose task was to detect and use the conceptual rules of their partners on a sorting task. The sorting task consisted of manual placement of cards containing the stimulus material into different piles according to a self-imposed criteria. English words were printed on cards and were representative of both high and low frequencies. In addition, simple and complex patterns were placed on cards bearing 100 small squares. The simple pattern cards had two crosses randomly placed on the grid, and the complex pattern cards had eight crosses placed at random on the grid. Subjects sorted both pattern and word cards. These various stimulus

arrays did not produce differences in speed of concept learning or number of categories used during the pre-recall sorting for either the subjects who were free to impose their own organization or their constrained partners who had learned the task.

Mandler and Pearlstone's finding that stimulus differences were not crucial and their conclusion that a preferred organizational scheme is automatic may apply to an adult population but may not necessarily hold for children. This might be due to the fact that processing all of these types of information, i.e., words and patterns were within the developmental capabilities of adults. Mandler and Stephens (1967) expanded this notion with a group of children, hypothesizing that the children would automatically impose a personal organization on any array of stimuli. They hypothesized that, in order to be able to learn a different target organizational scheme, the children would first have to abandon their original organizational set. They predicted that it would take longer for constrained subjects to detect and use the organizational strategy determined by a group of subjects who were free to impose their own organization than it would take for those free-sorting subjects to arrive at their own organizational scheme. This increased time would be the result of attempts to disengage the automatic organization of constrained subjects. Although their results supported their hypothesis in that constrained subjects took more time and made more errors, an alternative explanation is possible. A different point of view would be to assume that time and errors,

increased due to a lengthy and variable selection process from among several organizational possibilities. Exercise of a preferred process may not be automatic for children. Selection of one that will meet at least minimum requirements of the task and falls within developmental capabilities may be more predictive of strategy choice in children. During the sorting task, the constrained subjects only had the experimenter's response of correct or incorrect relative to the target organization. Environmental information to direct the constrained subject toward specific organizational content was essentially absent. Constrained subjects were then forced to engage in hypothesis testing with organizational probes.

Strategy preference may be influenced by the stimuli being presented in the experimental list. Cole et al. (1971 tested third and sixth graders with objects, pictures of the objects, or verbal labels of the objects (auditorily presented). The stimuli were judged to be familiar to the youngest subjects on the basis of an object-naming task prior to the experimental condition. Pictures produced the same amount of recall and clustering organization as the actual objects, but they were more effective than words for increasing recall and clustering at both age levels. The advantageous effect of pictures over words declined with increasing trials. Responding in writing produced no greater recall than verbal responding, but the former

produced greater clustering than did the latter. This written-verbal difference decreased over trials for the clustering score. Actual objects may have an advantage over pictures in children younger than subjects in this study (Sigel, 1971).

A perceptual-conceptual continuum. There is evidence that children do organize in terms of being able to group or classify information and that their organizational schemes vary with age along a perceptual-conceptual continuum. Young children depend more on information provided by the environment (Denney & Actio, 1972; Sigel, 1971), whereas older children and adults are capable of spontaneously generating their own conceptual schemes or detecting schemes embedded in the stimulus material (Mandler & Stevens, 1967; Liberty & Ornstein, 1973).

If the term organization is limited to the ability to detect or impose abstract conceptual or classifying schemes, such as those described in studies of subjective organization and category clustering, it would probably be concluded that organizational skills of young children are limited. If, however, the term organization is expanded to include the ability to detect and exploit less abstract elements provided by a set of stimuli--whether these elements are perceptual or conceptual in nature--it becomes apparent that young children are capable of organizing information. When these less abstract schemes are used in a recall task, recall is facilitated (Moely & Jeffrey, 1969). In discussing this

perceptual-conceptual continuum of organization from a developmental point of view, several factors must be considered: (a) the nature of the material to be remembered (verbal versus non-verbal); (b) the organizational scheme from the experimenter's point of view as well as from the child's; (c) the degrees of development of an organizational scheme in terms of its availability to the child as well as in terms of the child's facility in its utilization; (d) task difficulty. The types of material to be remembered as well as the developmental status of a given organizational scheme will help determine task difficulty. Other factors, such as decreasing the amount of processing time, increasing the amount of information to be processed, and unfamiliarity of items might increase task difficulty to the point that the subject resorts to a more primitive mode of organization. Even adults have been reported to abandon higher-order, conceptual organizational schemes in favor of perceptual saliency when task difficulty increases. For example, Mandler and Pearlstone (1966) used both high and low frequency words with adult subjects. The subjects reverted to use of beginning letters as an organizational scheme for low frequency words but applied conceptual organization to high frequency words.

Rote versus organized recall. There is some evidence that rote recall as a memory process precedes the use of organization, both developmentally and in terms of responding to task demands. For purposes of the present discussion, rote recall refers to the tendency of young children to recall items in the order of presentation in a free recall situation. Even when items are presented to children simultaneously, young children tend to recall items corresponding to the order of spatial positions. The first item in a row of pictures is generally recalled first, the second item in the row recalled second, and so forth. This tendency might be related to primitive perceptual development when an item's spatial position is a more salient dimension for young children than a dimension inherent in the item itself. Kobasigawa and Middleton (1972) investigated category clustering in a free-recall task for kindergarten, third-grade and fifth-grade children. They found that kindergarten children failed to organize the pictured items by conceptual categories when the items were presented simultaneously. Instead, their order of recall reflected the order of presentation of the items. Third graders appeared to be in a transition stage, since some of them used category organization rather than serial order as a basis for their recall, but some of them did not.

Lange (1973) also examined the tendency for young children to recall simultaneously presented pictures according to the spatial position of presentation. Kindergarten children showed

a marked tendency to have greater recall for the first item in each row. Fifth- and ninth-grade children did not show this tendency. Since young children tend to recall items in sequential order even during simultaneous presentation, it is possible that successive presentation of items might truly bias recall in favor of serially ordered recall. Moely and Jeffrey (1974) trained a group of six- and seven-year-olds to organize pictures by categories and compared their recall and organization with a control group. Half the subjects in the training group and the control group received items presented simultaneously. The other half in each group received items presented successively. In both the trained and the control groups, responses were not related to the order of presentation of the items for either method of presentation. These results for the simultaneous presentation groups are in disagreement with Kobasigawa and Middleton (1972) and Lange (1973). Procedural management of the control group in the Moely and Jeffrey (1974) study may account for the failure to find order effects. While control subjects were being familiarized with the task, they received sorting experience with the items and ultimately were able to view the total array since each item was left in the subjects' view after it was presented. The grouping was determined by the examiner, however, which should preclude personal organization on the part of the subject. These conditions might explain the failure to find ordered recall during

simultaneous presentation. Since successive presentation might be expected to bias young children toward ordered recall, failure to find ordered recall in the successive presentation condition of this study might seem surprising. However, prior experience at simultaneous viewing of the items, just prior to the experimental task, might also account for these results.

It might be possible to test the developmental salience of ordered recall versus organized recall by using a repeated-measures design with children of different ages. Perhaps there are ages when children might be more biased in favor of ordered recall under conditions of serial presentation as compared to simultaneous presentation. Younger children, if they are not given simultaneous viewing experience, may rely on ordered recall for both simultaneous and successive presentation. Older children might be able to organize recall under either condition, but children in transition might produce ordered recall during successive presentation and organized recall during simultaneous presentation. The list order effects found in the Appel et al. (1972) study for both simultaneous and successive presentation suggest that the list presented second produces greater organization. According to the successive presentation--ordered recall bias explanation--the order of the task should make no difference in very young children if

chronological age can be used as an index of developmental sophistication. Under these conditions, however, it may be difficult to control for practice effects.

In a multitrial free recall task, Cole et al. (1971) examined children's tendency to recall items in the order that they were presented rather than to utilize the organizational scheme that was potentially available. Children from grades one, three, and eight were asked to recall pictures of category representatives presented in blocked and random fashion. If items were recalled in the same order as they were presented, no category organization would have occurred. They found that the correlations between input and output orders for each group decreased across trials, with the differences between age groups were attributable to differences found in the first trial. Eighth graders showed a positive correlation on the first trial and a negative correlation on succeeding trials. The negative correlation means that the last items in the list were recalled first after the initial trial. This outcome could be interpreted as evidence for a short-term memory store where items are maintained on a rote basis without the need for organization. Since organization had its greatest effect on the middle items of the list, organization is assumed to operate after rote recall has reached its limit of efficiency. The first-trial positive correlation suggests

that output order was determined by input order only at the beginning of the experimental task. Since measures of organization increased with trials, it might be assumed that organization schemes replaced ordered rote recall.

Perceptual organization. Perceptual organization is based on some descriptive quality inherent in the stimulus items. Traditionally, the term organization refers only to more abstract dimensions of meaning. If this traditional definition of organization is maintained, then cognitive activity or classifying schemes according to perceptual dimensions are eliminated, even though they might account for increases in recall of children at developmental levels preceding higher order organization schemes based on abstract meaning.

The importance of perceptual organization as a memory process should not be overlooked, especially in view of the possible developmental significance of reports of idiosyncratic organizational schemes (Liberty & Ornstein, 1973; Moely & Jeffrey, 1974). Sigel (1971) has reviewed his research concerning the developmental significance of certain stimulus attributes, such as form and color. In the review, he differentiates among the organizational criteria used by children. According to Sigel, descriptive criteria depend on the physical characteristics of the stimuli, such as color, form, and size. Relational-contextual criteria refer to the tendency for young children to classify items on the basis of their functional characteristics. For example, from a relational-contextual

point of view, spoons are likely to be classified with coffee cups because they are used to stir coffee. Both criteria have been found to vary with sex and social class (Sigel, 1971). It should be noted that both sex and social class may also have developmental implications that are consistent with general developmental principles. That is, impoverished environments are often assumed to contribute to less sophisticated or to a slow rate of development, and sex differences may reflect different rates or levels of sophistication of development for males and females. Relational-contextual classifying schemes are considered more developmentally advanced than descriptive criteria and are more abstract, since they are not bound to the physical characteristics of the stimuli. Relational-contextual grouping, however, is considered less analytical and abstract than category clustering since the former is often made possible through over-learned associations. Lange (1973) argued that these associations may be rote in nature and should not be considered representative of organization.

Sigel (1971) pointed out that children's categorization styles vary as a function of the type of material that they are classifying. Things that are familiar to children are to be classified at a higher more abstract level than are things less familiar. In other words, things that are familiar to children are apt to be classified according to relational-contextual criteria sooner than are things less familiar. Sigel's point is consistent with the previous discussion of

the development of the possession-utilization gradient. To illustrate, a child may possess and be able to utilize descriptive criteria while he only possesses relational criteria if familiarity of the material ranks #3 on a familiarity scale of 1-5 (5 being the least familiar). If familiarity ranks #2, he might be able to use relational criteria. If familiarity ranks #4, he may not be able to use even descriptive criteria, even though he possesses the ability. Increasing familiarity may have the effect of decreasing task difficulty. Decreasing task difficulty may allow a more developmentally sophisticated level of organization to operate.

Denney and Acito (1974) screened two- and three-year-olds for their ability to classify stimuli according to similarity on the dimensions of color, shape, size, size and shape combined, and color and shape combined. Some children in this young age range were able to classify geometric stimuli according to similarity in a spontaneous manner. Of those who were not spontaneously able to classify completely a set of items, 51 children were selected for category training. Greater improvement in classifying was found in a training condition where the experimenter demonstrated the classifying scheme than in the training condition where the child was reinforced for correct responses which he generated for himself. The significant point for the present discussion of perceptual classification is that spontaneous descriptive or perceptual classifying was evident in children as young as two and three

years of age. Earlier studies by Denney indicated that this perceptual organizational ability is present in a majority of four-year-olds (Denney, 1972a, 1972b). In another study (Denney & Ziobrowski, 1972) to be discussed more fully later, organization of abstract meaning, rather than stimulus attribute, along a similarity dimension was not present in fourth grade children but was present in adults. This finding of similarity in organization in young children and adults supports the inverse relationship between task difficulty and utilization of higher level of organization. It also supports the notion that perceptual classifying (stimulus attribute) should be considered a form of organization. In other words, if a child is provided with developmentally appropriate things to organize (e.g., stimulus attributes rather than abstract meaning or perceptual processing rather than conceptual processing) a relatively high level of organization (e.g., similarity dimension) can take place, using the spoon example, similarity organization at the higher abstract level would classify it with knives and forks as "things to eat with." Slightly lower functional or complementary classification paired spoon with coffee cup because one is used with the other.

Using third- and fourth graders and college students, Bousfield and Whitmarsh (1958) found shifts in modes of organization. They predicted that third- and fourth graders would process 25 items according to the physical dimension of color and that college students would classify according to taxonomic

categories. The stimuli were pictures painted in appropriate colors, such as shoe and bear painted brown, and boot and dog painted black. Each picture had the name of the item printed beneath it. The items were presented in random order serially, and the subjects were instructed to remember the titles. As predicted, the highest percentage of color clustering took place in third graders. An unexpected finding was that color clustering was lower in the fourth graders rather than in the adult subjects. This may not seem as unexpected if one considers that the instructions were to remember the titles. These instructions may have induced fourth graders to avoid classifying by color. Adults, on the other hand, were expected to classify by titles rather than color, and the instructions may have merely insured adult predisposition. More interesting developmentally is the fact that third graders continued to classify by color--a more primitive mode--in spite of instructions to do otherwise. Information is not given as to whether the third graders could read the titles, but reading ability is likely since the items were simple.

The organizational salience of auditory-perceptual characteristics of verbal material was compared to the salience of semantic characteristics in a study by Hasher and Clifton (1974). Since the words were presented in visual form, there was some confounding of sound and orthographic characteristics, but the perceptual-conceptual developmental principle may still be considered. Critical words that were phonetically related and

critical words that were semantically related were embedded in a long list of items and presented to second and sixth graders. The younger subjects apparently used sound as a basis for organization since it was found that second graders showed greater clustering of phonetically-related words than of semantically-related words, regardless of whether the items were presented in random or blocked form. On the other hand, sixth graders used semantic relationships as a basis of organization and showed more clustering of the semantically-related items. Even if the acoustic organization was interpreted as orthographic-visual organization, the perceptual bias of the younger children and conceptual orientation of the older children remains the same. It should be noted, however, that older subjects do not always utilize semantic and conceptual relationships. For example, Neimark et al. (1971) reported that college students often resorted to categorizing picture items by alphabetizing the names. This apparently represents the adults' translation of the picture items into verbal form before application of a perceptually-oriented organizational strategy.

Functional organization. Lange and Jackson (1974) argued that younger children make poorer approximations to experimenter-defined organization, such as category clustering, and are, therefore, credited with clustering scores that underestimate their organizational abilities. To test this notion, subjects from grades one, four, seven, ten, and college

were allowed to sort picture items until they produced identical sorts twice in succession. Thus, organizational stability was insured prior to recall. The items could be classified according to either descriptive qualities, functional-contextual relationships, or taxonomic categories. Regarding descriptive criteria as a basis for classifying, Lange and Jackson (1974) are in agreement with Sigel (1971) and Denney and Acito (1974) that descriptive criteria are primarily evident in the very young, preschool years. The Lange and Jackson subject sample began at the first-grade level and demonstrated minimal sorting on the basis of descriptive criteria. College students sorted according to class-inclusion (i.e., taxonomic category) criteria to a greater extent than fourth graders. The authors had predicted a continuous developmental increase in the use of class-inclusion criteria and a continuous decrease in the use of functional criteria. Instead, they found an increase in functional criteria for first and fourth graders and an increase in class-inclusion criteria after the fourth grade. The continuous increase in class-inclusion criteria for older subjects was accompanied by a continuous decrease in functional criteria. If Sigel's (1971) criteria hierarchy holds, the functional increase in the younger children should be accompanied by a continuous decrease in descriptive criteria. Such information was not available in this study but might be obtained by using younger subjects and/or more difficult items. Younger subjects should allow more descriptive criteria to appear

spontaneously. More difficult items should require older subjects to revert to descriptive criteria from functional criteria.

Denney and Ziobrowski (1972) favored the explanation that young children are capable of organization but that their organization is qualitatively different from adults. These authors proposed that category organization undergoes a developmental change from categories based on complementary relationships to categories based on similarity relationships. The term complementary appears, from the authors' item examples, to be analogous to functional-relational relationships discussed by Sigel (1971). Similarity relationships appear analogous to category classification (Lange & Jackson, 1974). First graders and college students were presented with two lists of stimulus words. In one list, the words were composed of complementary pairs (e.g. pipe and tobacco); in the other list, the words were composed of similarity pairs (e.g. king and ruler). The associative frequencies of the two lists were the same. The words of a pair were presented in successive order. Denney and Ziobrowski reported that children organized more than adults on the complementary list but that adults organized more than children on the similarity list. These results confirmed the hypothesis that children as young as first graders are able to organize material in a recall task, but that the basis for their organization is different from that of adults.

In this study, adults recalled more words than children on both the complementary and similarity lists. Since age-related differences in clustering were found to be list specific but age-related recall differences were not, the authors suggested that recall did not increase as a function of organization but rather as a function of associative value on both lists. The associative value explanation might account for increases in adult recall for both lists, if it is assumed that adults used the associative value as a form of organization. If this is true, then there is no explanation for associative organization and complementary organization occurring simultaneously. It is doubtful whether even an adult subject can organize items successfully in recall according to two dimensions simultaneously, unless one dimension was actively processed and the items coincidentally were also members of the other dimension (Lange, 1973). Simultaneous dimensions of organization seem even more unlikely for children. The possession-utilization continuum offers an alternative explanation. If the utilization of the two types of clustering criteria are differentially developed in adults and children, they should be differentially effective in facilitating recall. Greater recall for adults on both lists would then be expected. Since the stimuli were verbal and were auditorily presented, adults would be expected to possess more facility than children, regardless of the dimension of organization (Cole et al., 1971; Hasher & Clifton, 1974; Neimark et al., 1970).

Liberty and Ornstein (1973) showed evidence that functional or similarity organization does, in fact, develop by degrees. They presented high frequency words to fourth graders and adults, and found that 70% of the fourth graders sorted the words on the basis of very distinct and well-defined functional relationships. Fifty-five percent sorted according to functional criteria of a less distinct nature. This finding of a sequence of development of functional criteria is consistent with the degrees of possession hypothesis proposed by Moely et al. (1969) and would explain the differential development of complementary organization between children and adults in the Denney & Ziobrowski study (1972).

Adult recall in the Denney and Ziobrowski (1972) study might have been better on the list with similarity organization because similarity is a higher order form of organization and is, therefore, more efficient than complementary organization. As a result, similarity organization may have a greater facilitative effect on recall than complementary organization. Children, on the other hand, may not have yet reached developmental levels which make similarity organization possible. Even if children attempted to utilize similarity organization for recall of items from the similarity list, their utilization of such organization would not have reached the same degree of development as that of adults. Children's recall of similarity items would only be commensurate with their degree of utilization and would thereby produce a lower level

of recall than that of adults. Adult utilization of similarity organization would be developed to a higher degree and, therefore, capable of facilitating greater recall. Children's lower level of recall on the complementary list in spite of high levels of complementary organization could be explained if the nature of their complementary organization was so ill-defined or non-specific as to render it ineffective in recall relative to adult recall, even though adults did not organize along the complementary dimension.

Conceptual organization. As traditionally defined in the previous discussion, organization refers to the ability to classify or group items according to some rule or concept that is not necessarily inherent in the items themselves. The use of stimulus items representing members of different taxonomic categories is an experimenter's attempt to provide a possibility for classification to the subject. Then, to be credited with organization, the subject merely has to detect the possibility and utilize it. Since young children often fare rather poorly in this type of experimenter-defined task, the role of organization in the memory of children is sometimes unclear with traditional definitions of organization.

The preceding sections provide evidence that children do organize but that their organizational strategies are different from adults'. From a developmental point of view, this conclusion should not be surprising. Although high-order conceptual organization, such as that found in category

clustering, may be beyond the developmental range of children at certain ages, it is unnecessary to assume that they are incapable of organization. However, studies involving category clustering provide valuable information about the developmental appearance of that particular type of organization. For this reason, the following studies will be reviewed from the standpoint of cognitive development at the conceptual level.

Lange (1973) illustrated that it is difficult to construct a list of items that contains only conceptual categories as a potential source of organization. In constructing a list, the investigator may also include lower order rote associations that the child has experienced with great frequency pre-experimentally. Whether or not associative affinity of items is a form of conceptual organization or a form of rote recall probably reflects the degree of familiarity and/or difficulty of the items and their pairing from the point of view of the child. Nevertheless, Lange (1973) demonstrated that young children do not organize on the basis of conceptual taxonomic categories when frequently associated items are eliminated from the list. Certain associative bonds may be in the child's repertoire and coincidentally belong to the same conceptual category. If the items hat and coat were among a list of items which could be grouped, from the experimenter's point of view, according to the conceptual categories of clothes, animals, and food; and, if the child consistently recalled hat and coat together--despite the fact that they had not been presented together in the study list--it might be assumed that the child was using high order

conceptual grouping. The child, in fact, might be responding on the basis of an association between hat and coat, generated from his life experiences.

Lange (1973) studied kindergarten, fifth graders, and ninth graders and used picture items representing the conceptual categories of food, clothing, furniture, and animals. He attempted to eliminate associative bonds between words by comparing his items with word-association norms. By controlling for these possible rote associations, he found that spontaneous order conceptual organization did not appear in kindergarten and fifth-grade children under free recall conditions. Only ninth graders organized spontaneously on the basis of conceptual categories. If young children possessed the ability to organize by taxonomic categories but failed to utilize this skill spontaneously for the purpose of assisting their recall, certain organization cues might serve as inducements to promote the utilization of the skill and produce a corresponding increase in recall and organization. Two types of cued or inducement conditions were used in this study to provide this evidence. In both conditions, subjects were asked during the study period to point to all the items that belonged to the specific category whose name was called out by the experimenter. In other words, as the experimenter said "animals," the subjects pointed to all instances in the array that belonged to the category of animals. This task insured that the subjects possessed the ability to categorize the pictures. In one cued or induced recall condition, the

experimenter gave the subject the category label (animals, food, clothing, or furniture), and he was to recall all the items belonging to that label together. The subjects were informed of this recall technique during the study period. Providing subjects with category cues at the time of recall produced no greater recall or organization than was found for subjects in the uncued free recall condition. Category cues at the time of recall apparently provided insufficient inducement for the utilization of category organization. However, subjects who were provided cues at the time of study and recall, organized and recalled more at each grade level than the subjects in the free recall condition. Perhaps the relevant task orientation and category cues provided at the time of study facilitated storage of information which, in turn, insured greater utilization of category organization at recall. This explanation would be consistent with the results of Worden (1974) concerning the stability of storage organization.

Kobasigawa (1970) used pictures from eight categories and found recall and clustering increases for children from grades one, three, and six. These increases depended upon the recall condition which varied the amount of cuing or utilization inducement. All ages showed greater recall and clustering when they utilized cues at recall. Older children were more spontaneous in utilizing recall cues and required less prompting to raise the level of recall and organization than did younger children. First- and third-grade children performed no better under

moderate cuing conditions than under conditions of no cuing. Directive cuing (stronger inducement) was necessary for effective utilization of organization in first graders. For sixth graders, the organization that occurred spontaneously in the free recall condition was equivalent to that which occurred with moderate cuing. For all ages, greater use of organization cues, whether spontaneous or induced, facilitated the number of items recalled. First and third graders' recall was similar, but sixth graders' recall was superior. This discrepancy between the linear development of recall and organization is not unusual in studies involving both category clustering and subjective organization (Cole et al., 1971; Denney & Ziobrowski, 1972; Laurence, 1966; Neimark et al., 1971; Rosner, 1971; Yussen et al., 1974). This finding is consistent with the idea that possession of an ability and utilization of an ability develop at different rates or by degrees. Otherwise, the question is posed: If recall is dependent on organization, how can the same level of organization account for different levels of recall?

In a free-recall task, Kobasigawa and Middleton (1972) investigated the utilization of category organization by kindergarteners, third graders, and fifth graders. The items in this study were presented, both in blocked form with and without category labels or organization cues and in random order with and without labels. At all ages, blocked presentation in which the items of a category were presented together, increased the

use of category organization, i.e., increased the amount of clustering in the subjects' protocols. In the random presentation condition, fifth graders spontaneously used the category organization, but first graders did not; third graders were found to be in a transition stage, i.e., some used category organization spontaneously, and some did not.

The question arises as to whether clustering under conditions of blocked presentation represents increased use of category organization or rote recall (Worden, 1974). If it is assumed that organization takes place with blocked presentation, then the blocking probably serves to increase the salience of the categorical nature of the items and serves as an utilization inducement. A comparison of recall scores suggests that organization rather than just rote serial learning is operating during blocked recall. If organization serves to improve recall, then recall should be better during blocked presentation than random presentation. Blocked presentation increased recall scors for third graders and fifth graders but made no difference in the recall of kindergarten children. Responses of kindergarten children, in this study, reflected the input order of the item even during random presentation. Providing kindergarten children and third-grade children with appropriate category labels was not sufficient prompting either to make them aware of the categorical nature of the items or to make them utilize category organization. Category labels had a facilitory effect only on the organization of fifth graders. In a post-recall sorting task, all subjects were asked to group the

pictures that they believed "went together." Although kindergarten children produced reasonable groupings, their groupings did not reflect the taxonomic categories present in the list. In a post-test interview, when the examiner gave the category label, even kindergarten children identified all the experimental items with complete accuracy. This ability to identify category members indicates that they possessed knowledge of the category relationships, even though they did not use their knowledge either in the recall task or in the spontaneous sorting task.

Moely et al. (1969) reported low amounts of absolute clustering by categories in children from kindergarten, first, and third grades. Their recall was likewise significantly below that of fifth graders. Provision of category labels was ineffective inducement for utilization of category organization in kindergarten and first graders. Recall and clustering increased only under more explicit teaching conditions. Third graders were again found to be at a transition stage, since the milder inducement of category labels was just as effective at increasing recall and organization as the more explicit teaching condition. Spontaneous organization utilized by fifth graders was sufficient to increase recall, and provision of either category labels or more explicit instructions had no added effect on recall.

It should be noted that these results are in agreement with Lange (1973), Kobasigawa (1974), and Kobasigawa and Middleton (1972). Eleven years of age seems to represent the

critical age at which spontaneous category clustering as a form of organization can account for increases in recall, although there is evidence that category organization and recall develop in a stepwise rather than a linear fashion. To state that category organization accounts for recall by age eleven does not imply that other forms of organization cannot account for recall at younger years. However, their effectiveness may be less. In short, if category organization is associated with recall increases in children, other forms of organization may also have a facilitative effect on recall. Even category clustering can appear spontaneously in kindergarten children. Its appearance at that young age, however, suggests that mode of organization is more related to developmental sophistication than chronological years. When the kindergarten subjects in the Moely et al. (1969) study were divided into those with high category clustering scores and those with low clustering scores, high clustering kindergarten children had greater recall. It is unclear to what level recall was facilitated by utilization of category organization compared to other ages utilizing categorization. This information would speak to developmental efficiency in organization utilization.

Subjective organization. The preceding review, outlining different modes of organization that appear in children with increasing age, has been primarily concerned with experimenter-defined organization of one type or another. Studies involving subject-defined organization are relevant to the issue of

whether children are able to spontaneously impose their own organization on a set of items in the absence of any obvious cues inherent in the items themselves. Laurence (1966) patterned a developmental study after Tulving's (1962) original subjective organization study which used adult subjects. Laurence (1966) tested children from kindergarten, first, third, and fifth grades as well as adults ranging in age from 20 to 22 years and elderly subjects ranging in age from 68 to 84 years. Sixteen unrelated pictures were successively presented for each of 16 trials. After each trial, subjects were asked to recall the items in any order that they chose. Laurence found that the children did impose some subjective organization on the items. Even after sixteen study trials, however, children barely reached the level of organization that the adult subjects demonstrated on the first trial. Furthermore, there were no differences in the amount of subjective organization among any of the children's groups, but there were differences in the amount of recall for all ages including the children's groups. In the light of age-related recall differences despite a lack of age-related differences in organizational clustering, Laurence concluded that something other than subjective organization must be accounting for the differences in recall. Laurence contrasted her developmental data with Tulving's (1962) findings which supported the hypothesis that organization accounts for increases in recall.

The stepwise development of organization in the face of linear increases in recall may likewise be operating in the case of subjective organization. Since it may be more difficult for children to design their own organizational schemes than to detect and utilize one provided by the experimenter, the threshold for age-related differences would be elevated. In addition, since the method of calculating subjective organization depends on sequential redundancy of output items in repeated pairs, actual organization present may be underestimated.

Nelson (1969) compared subjective and category organization. She presented fifteen words auditorily to five- and eitht-year-olds and concluded that there were no age-related differences in organization if the organization did not depend on the use of taxonomic categories. The amount of subjective organization of five-year-olds was equal to or greater than that of eight-year-olds on an uncategorized list. This failure to find an increase in subjective organization between ages five and eight years is in agreement with Laurence (1966). In terms of the mode of organization that is most effective for recall, the five-year-olds showed better recall by imposing their own organization on unrelated items than by utilizing taxonomic categories, despite the fact that the items on the category list had been self-generated on a task prior to the experimental conditions. The fact that five-year-olds generated the taxonomically-related list in this study is evidence that they possessed the knowledge of the categorical

nature of some words but could not utilize this knowledge effectively as a basis for organizing their recall. Eight-year-olds, on the other hand, found use of self-generated category organization a more effective organizational scheme than subjective organization. It must be remembered, however, that measures of subjective organization make no attempt to define the qualitative nature of the organization. It is possible that young children detected some associative value among some of the items which might represent a lower level of conceptual relatedness than the category relatedness which they were unable to use effectively.

Cole et al. (1969) presented 20 words auditorily to children from grades one, four, six, and nine for five trials and compared the recall for related lists and unrelated lists. They reported that very little organization occurred for either type of the list, with only a slight increase in recall for related lists. The younger children from grades one and four showed little clustering until the fifth trial. Only sixth and ninth graders clustered on the earlier trials. These authors offered two explanations for the low level of clustering: a difference in measuring technique from that used by Tulving and Laurence, and too few trials. Tulving (1962) noted that even adults failed to show fairly firmly established subjective organization prior to eight trials.

Liberty and Ornstein (1973) compared self-imposed organization of fourth-grade and adult subjects for words printed on cards. The subjects sorted all the cards, using any organizational scheme they wished, and then recalled the items in any order. This sort-recall sequence lasted for six trials.

Fourth graders found it difficult to impose a stable organization (two identical sorts) within six trials. This may again represent limitations of studying subjective organization with so few trials. The children who demonstrated self-imposed organization during the sorting task failed to utilize this organization to any great extent in their recall. In other words, the organization reflected in the recall protocols of fourth graders was not the same organization they used during their sorting task. Items were grouped together in one manner during sorting but were regrouped differently in their recall. Fourth graders apparently utilized one form of organization for the purpose of sorting and a different form for the purpose of recall. It would be interesting to note developmentally-related differences in the form of organization for the two tasks. If it is assumed, that utilization of an organizational form for the purpose of recall depends on a fairly high degree of development of that form, recall organization should represent a more primitive form which has had the opportunity to be fully developed. Adults, on the other hand, used their sorting organization in their recall to a much greater degree. Fourth

graders' performances again indicated the ability to organize but an inability to apply a given subjective organization to the task of recalling the same information just previously organized.

Rosner (1971) used successive presentation of unrelated pictures to children from grades one, five, and nine for 12 trials. There was very little self-imposed organization in the free condition for first graders, but it increased substantially for fifth graders. First grade self-imposed organization was not as effective for facilitating recall as the organization resulting from instructions to "chunk" or form "mediational" links between items. Subjective organization was just as effective as chunking organization for ninth graders. In contrast to Laurence (1966), Nelson (1969) found increases in the amount of organization in children between grades one and five. These differences between the two studies might be due to measuring differences, since Laurence used Tulving's (1962) measure of subjective organization, and Rosner (1971) used a clustering measure (Bousfield and Bousfield, 1966). In both cases, however, the lists were theoretically unrelated, and the subjects were free to impose their own organization spontaneously.

From these studies, it appears that children at least eight years of age are capable of designing and utilizing their own organization of unrelated items to some extent. However, there is little evidence that children are able to utilize self-imposed organization on a recall task before this age. Even

fifth graders, however, find environmental sources of organization, such as instructions to chunk the items or to form mediational links, more effective for recall than the subjective organization of which they are capable. Imposing organization on unrelated items is apparently developmentally more difficult. Ninth-grade subjects are able to use subjective organization with enough facility that it produces just as great an increase in recall as environmental sources of organization. Ninth graders have apparently reached a level of developmental sophistication necessary to facilitate utilization of self-imposed organization for the purpose of increasing recall.

CHAPTER VII

SUMMARY

Experimental investigations testing for the presence or absence of organization in memory of children have been found to be a rich source of information concerning developmental changes in cognitive strategies used by children. In order to classify the entire developmental scope of these strategies used by children under the rubric of mnemonic organization, it is necessary to deviate from traditional definitions of organization. This discussion dealt with the issue of whether or not organization is present in children and its facilitative effect on recall from the standpoint that organization changes along a perceptual-conceptual developmental continuum. Two major obstacles for methodological and theoretical interpretation, not necessarily found in adult studies are: (a) children's awareness of memory-task demands, and (b) differential development of the possession of an organizational scheme and its utilization. The first of these obstacles may relate to limited attentional characteristics of young children, but there is also evidence that young children are not able to predict their own memory capabilities. In addition, they simply may not be aware that a memory task demands certain active cognitive strategies to assist their recall. In this case children may possess a cognitive strategy which would, in fact, assist their recall, but they fail to apply it to the task because they are unaware of the nature of the task. The fact that children

possess an ability in the absence of facilitated recall has traditionally been dealt with in the issue of whether or not children demonstrate a production deficit or a mediation deficit. An attempt has been made to reconcile this argument by use of a possession-utilization developmental continuum. In addition, this developmental continuum has been useful in attempting to reconcile apparent discrepancies in studies involving the presence or absence of category and subjective organization in children. Since both a production and mediation deficit can be documented in children's behavior, the possession-utilization continuum attempts to account for their developmental significance.

Subject-defined (subjective organization) and experimenter-defined (category) organization have been reviewed as methodological approaches to the study of children's memory. It is generally concluded that children find it easier to detect and utilize experimenter-defined organization than to generate and impose their own organization on unrelated items. Measures of subjective organization may not give a complete picture of what is being imposed. Young children depend on information coming from the environment as more efficient sources of organization. The ability to detect and utilize what is being provided by the experimenter, however, depends on whether the experimenter has provided something within a given developmental level of sophistication of the child. The assumed cause-and-effect relationship between organization has been found to

exist in children, if a developmentally appropriate dimension of organization is being considered. For example, first graders might not be expected to categorize items taxonomically if similarity is the dimension of organization under consideration by the experimenter. Since functional or complementary category organization precedes similarity from a developmental standpoint, first graders might be expected to organize categorically if functional relatedness is the dimension of organization under consideration by the experimenter.

Since information-processing models of memory deal with organization as a storage or retrieval process were historically generated from adult research, they fail to account for qualitative changes in organization in children. For that reason this paper has dealt with cognitive activity of children in a memory task rather than support for any particular model of memory.

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